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(19) (CA) **CANADIAN PATENT** (12)

(54) MULTIPOLAR PACING CONDUCTOR

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Abstract of the Disclosure

Multipolar pacing conductor of drawn brazed strand wires of MP35N alloy in a silver matrix coiled around a diameter D and wires taken off at predetermined spatial locations. MP35N alloy is 35% nickel, 35% cobalt, 20% chromium and 10% molybdenum. The wires of the multipolar pacing conductor are insulated with a suitable insulation and handle separate currents for each wire or group of wires. A multipolar, multifilar pacing conductor includes two or more wires wound in parallel on the coil.

MULTIPOLAR PACING CONDUCTOR

Cross References to Co-pending Applications

None.

Background of the Invention

1. Field of the Invention - The present invention relates generally to a surgical electrode lead, and more particularly, pertains to a multipolar pacing conductor.

2. Description of the Prior Art - One of the signficant prior art problems with pacing leads has been achieving small diameters for two or more conductors in a single pacing lead while still having low current consumption and high flex life of the pacing lead. Prior art pacing transvenous leads have required relatively large diameters for two or more conductors and have contributed reduced pacing system longevity due to the electrical resistance resulting in energy being consumed internally by the pacing lead and less energy being supplied to the heart. Some leads have required side-by-side configuration of similar sized conductors or coaxial arrangements of different sized conductors resulting in relatively large diameters. While the prior art pacing leads could be constructed to have low resistance, the leads would have limited flex life with an extremely high fatigue fracture rate and large physical size. While it was the intention of prior art pacing leads to achieve a balance between size, number of conductors, electrical resistance and flex life, such a balance resulted in some pacing leads that were less than satisfactory for atrial-ventricular or other advanced pacing systems.

The present invention overcomes the disadvantages of the prior art problems by providing a multipolar pacing conductor utilizing special materials, and special design and fabrication technique.

Summary of the Invention

The general purpose of the present invention is to provide a multipolar pacing conductor of drawn brazed strand (DBS) wire having low resistance and excellent flex life with an extremely low fatigue fracture rate, contributing significantly to increase pacing system longevity. Drawn brazed strand is disclosed in U.S. Patent No. 3,356,540. The multipolar conductor is a multifilar coil which has insulated wires to electrically separate different conductors.

According to one broad aspect of the invention there is provided a multipolar pacing conductor comprising: at least two drawn brazed strand wires wound circumferentially in a coil, said at least two drawn brazed strand wires insulated from one another, providing two or more separate current paths.

According to another broad aspect of the invention there is provided a multipolar pacing conductor comprising: at least two drawn brazed strand wires wound circumferentially in a coil wherein each wire takes off at a spatial predetermined location along a longitudinal axis of said coil for electrical connection to an electrode and a conductor at opposite ends of said wire.

According to one preferred embodiment of the present invention, there is provided a multipolar pacing conductor wherein each wire of a plurality of wires includes drawn brazed strand of a plurality of strands of MP35N alloy wound around a silver matrix and including insulation coating each of the wires whereby the composite material of each conductor yields low resistance and excellent flex life with an extremely low fatigue fracture rate contributing significantly to pacing system longevity.

According to a further embodiment of the present invention, there is provided a multipolar pacing conductor having a plurality of wires such as six by way of example and for purposes of illustration only wound in a coiled configuration, each of the wires having a plurality of wires surrounding a matrix where each of the plurality of wires are MP35N

alloy and the core is silver, and wires taken off at various predetermined distances along the longitudinal length of the coil. The wire or wires can be taken off singularly or in a plurality at any spatial location as predetermined.

A significant aspect and feature of the present invention is a conductor coil of the drawn brazed strand wire which has a low electrical resistance and high flex life.

The wire of the present invention consists of unique and novel two material wire such as MP35N alloy which comprises 35% nickel, 35% cobalt, 20% chromium and 10% molybdenum drawn brazed stranded around a core of silver by way of example and for purposes of illustration only, but not to be construed as limiting of the present invention. This wire provides a significantly lower electrical resistance along with increased flex life resulting in energy savings and extremely low fatigue fracture rate.

Brief Description of the Drawings

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, in which like reference numerals designate like parts throughout the FIGURES thereof and wherein:

Fig. 1 illustrates a plan view of a multipolar pacing conductor;

Fig. 2 illustrates an end view looking along lines 2-2 of Fig. 1;

Fig. 3 illustrates an opposing end view looking along lines 3-3 of Fig. 1; and,

Fig. 4 is a cross-sectional view taken along lines 4-4 of Fig. 1.

Description of the Preferred Embodiment

Fig. 1, which illustrates a plan view of a multipolar pacing conductor 10, shows six conductors 12a through 12f coiled on a diameter D which can be either constant or vary. The coil starts from the left-hand side of the figure and extends to the right-hand side of the figure on the same coil diameter D. Each of the wires 12a through 12f is a drawn brazed strand of a

plurality of strands in a matrix. Connector terminals and electrodes affix onto the respective ends of each of the wires, but are not illustrated in the figures for purposes of clarity of illustration in the drawings. In this instance, and by way of example and for purposes of illustration only, the outer strands are MP35N alloy which is an alloy of 35% nickel, 35% cobalt, 20% chromium, and 10% molybdenum around a silver core and which is subsequently drawn brazed and stranded, a process practiced by Ft. Wayne Metals Research Products, Inc. in Ft. Wayne, Indiana, as previously discussed in the Summary of the Invention. Each of the drawn brazed strand wires is subsequently coated and covered with an insulation such as polyurethane, Teflon or other like chemical composition. Subsequently, the plurality of wires 12a-12f are wound on the diameter D forming the multipolar pacing conductor 10.

Fig. 1 illustrates wires 12a and 12b of the multipolar pacing conductor 10 initially taking off at an angle of 32° with respect to the longitudinal axis of the multipolar pacing conductor 10. Likewise, wires 12c and 12d take off from the multipolar pacing conductor 10 at an angle of 16° with respect to the longitudinal axis of the multipolar pacing conductor 10. Finally, wires 12e and 12f take off at an angle of 8° with respect to the longitudinal axis of the multipolar pacing conductor 10. The pitch of the wire in angular degrees is by way of example and for purposes of illustration only and is determined by the diameter of the coil, diameter of the wire, number of filars, and spacing of the wires, and is not to be construed as limiting of the present invention.

Fig. 2, which illustrates an end-view taken along line 2-2 of Fig. 1, shows wires 12a and 12b taking off in an upward direction by way of example and for purposes of illustration only from the multipolar pacing conductor 10 and wires 12c and 12d take off in a downward

direction from the multipolar pacing conductor 10. The figure illustrates the diameter D being constant throughout the longitudinal axial length of the multipolar pacing conductor 10, but is not to be construed as limiting to the present invention.

Fig. 3, which illustrates an end-view taken along line 3-3 of Fig. 1, shows the wires 12c and 12d extending upwardly from the multipolar pacing conductor 10.

Fig. 4, which illustrates an enlarged view of the wire 12a, shows the wire 12a with surrounding insulation 14a of a polyurethane, Teflon (Trade Mark) or like chemical composition, and the drawn brazed strand 16.1 through 16.6 of MP35N in a silver matrix 16.7, all of which has been drawn, brazed and stranded as previously discussed in the Summary of the Invention.

Preferred Mode of Operation

The multipolar pacing conductor 10 can consist of two or more wires capable of handling separate currents. By way of example and for purposes of illustration only, Fig. 1 illustrates a six polar lead for each of the wires 12a through 12f having insulation 14a through 14f where 14a is only illustrated for purposes of clarity in the figures and provides for handling of separate currents. The specific winding and takeoff of the wires in pairs at predetermined spatial locations along the longitudinal axial length of multipolar pacing conductor 10 has been by way of example and for purposes of illustration only.

The gist of the invention is that each of the individual wires handles separate currents along the multipolar pacing conductors which is wound on the diameter D with wire or wires coming off at different angles and at different longitudinal locations with respect to the longitudinal axis of the multipolar pacing conductor 10.

The multipolar pacing conductor 10 is inherently multifilar in that two or more wires of the multipolar pacing conductor 10 can be wound in parallel, adjacent to each other, and with one of the separate current carrying wire or wires not needing to be insulated.

Various modications can be made to the multipolar conductor of the present invention without departing from the apparent scope thereof. For instance, the drawn brazed strand wire could be stainless steel around a silver core, or any other suitable metal stranded around a suitable core.

Having thus described the invention, there is claimed as new and desired to be secured by Letters Patent:

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. Multipolar pacing conductor comprising: at least two drawn brazed strand wires wound circumferentially in a coil, said at least two drawn brazed strand wires insulated from one another, providing two or more separate current paths.

2. Multipolar pacing conductor comprising: at least two drawn brazed strand wires wound circumferentially in a coil wherein each wire takes off at a spatial predetermined location along a longitudinal axis of said coil for electrical connection to an electrode and a conductor at opposite ends of said wire.

3. Multipolar, multifilar pacing conductor comprising:

a. plurality of insulated and uninsulated wires wound on a diameter D along a longitudinal length, each of said wires taken off at spatial predetermined locations along the longitudinal axis of said coil; and

b. at least one of said wires being uninsulated whereby said insulated wires handle separate currents and said uninsulated wire handles equal currents.

4. The conductor of Claim 2 wherein at least two of said drawn brazed strand wires are insulated from each other providing two or more separate current paths.

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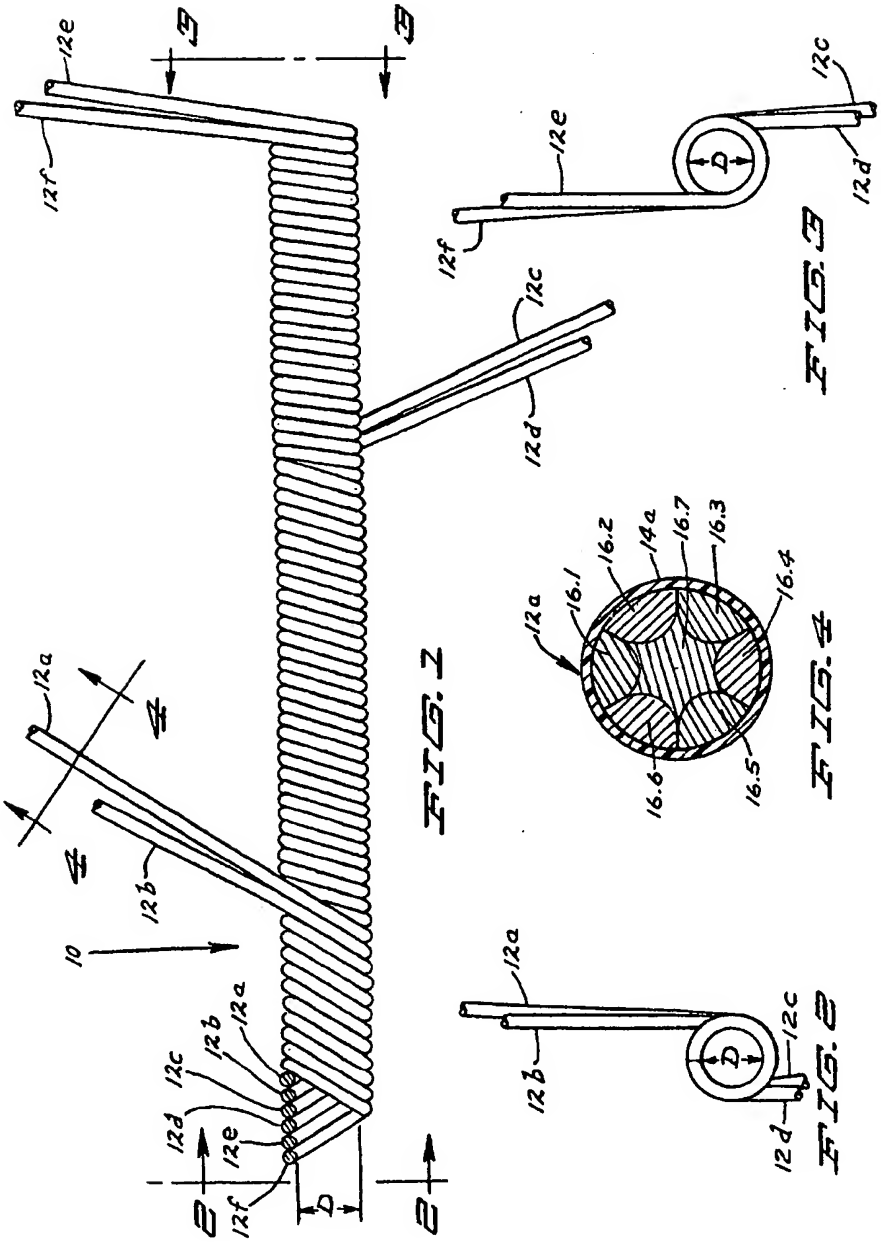

FIG. 3

FIG. 2

FIG. 4

FIG. 2

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